WE CLAIM:

1. A method of conductive material electrodeposition on a workpiece surface having a cavity to form a substantially flat conductive layer, the method comprising:

determining a first transition current density that is capable of filling the cavity with the conductive material forming a substantially flat profile over the opening of the cavity;

determining a second transition current density that is capable of filling the cavity with the conductive material forming a substantially convex profile over the opening of the cavity, wherein the second transition current density is larger than the first transition current density;

determining a third transition current density that is capable of filling the cavity with the conductive material forming a substantially flat profile over the opening of the cavity, wherein the third transition current density is larger than the second transition current density;

performing an electrodeposition process on a plurality of workpieces, each electrodeposition process comprising the steps of:

applying an initial process current density as the workpiece surface enters the process solution, wherein the initial current density is lower than the first transitional current density;

applying a first process current density to fill the cavity with the conductive material, wherein the first process current density is substantially the same as the first transition current density; and

applying a second process current density to form a substantially flat conductive layer; wherein the second process current density is substantially the same as the third transition current density.

2. The method of Claim 1, wherein the step of applying the first process current density is applied for a first predetermined time and the step of applying the second process current density is applied for a second predetermined time.

3. The method of Claim 2, further comprising applying a third process current density before the first process current density and after the initial process current density for a third predetermined time, wherein the third process current density is higher than the second process current density, and the third predetermined time is shorter than the first and the second predetermined times.

4. The method of Claim 2, further comprising applying a third process current density after the first current density and before the second process current density for a third predetermined time, wherein the third process current density is higher than the second process current density, and the third predetermined time is shorter than the first and the second predetermined times.

5. The method of Claim 1, further comprising applying the first process current density for a first predetermined time and applying a pulsed process current density that varies between a third process current density and the first process current density for a second predetermined time, wherein the third process current density is higher than the second process current density.

6. The method of Claim 1, further comprising applying the first process current density for a first predetermined time and applying a first pulsed process current density that varies between the second process current density and the first process current density for a second predetermined time.

7. The method of Claim 9, further comprising applying a second pulsed process current density for a third predetermined time after the first pulsed process current density, wherein the second pulsed process current density varies between a third process current density and the second process current density, wherein the third process current density is higher than the second process current density.

8. The method of Claim 1, further comprising repeating the steps of applying the first process current density and the second process current density multiple times.

9. A method of conductive material electrodeposition on a workpiece surface having a cavity to form a substantially flat conductive layer, the method comprising:

determining a first transition current density that is capable of filling the cavity with the conductive material forming a substantially flat profile over the opening of the cavity;

determining a second transition current density that is capable of filling the cavity with the conductive material forming a substantially convex profile over the opening of the cavity, wherein the second transition current density is larger than the first transition current density;

determining a third transition current density that is capable of filling the cavity with the conductive material forming a substantially flat profile over the opening of the cavity, wherein the third transition current density is larger than the second transition current density; and

performing an electrodeposition process on a plurality of workpieces by depositing the conductive material onto the surface of the workpieces using a variable current density including an initial process current density, a first process current density and a second process current density to form the flat conductive layer;

wherein the first process current density is substantially the same as the first transition current density, and the second process current density is substantially the same as the third transition current density.

10. The method of Claim 9, wherein the first process current density is applied for a first predetermined time and second process current density is applied for a second predetermined time.

11. The method of Claim 10, wherein the first predetermined time period is equal to the second predetermined time period.

12. The method of Claim 10, wherein the first predetermined time period is longer than the second predetermined time period.

13. The method of Claim 10, wherein the first predetermined time is shorter than the second predetermined time.